EXHIBIT 21

EXHIBIT 21 – U.S. Patent No. 11,876,548

Claim 1	Accused Advanced Antenna Mobile Devices[1]
[1PRE] A wireless device configured for avoiding radiation of a user or structure, comprising the steps of:	The Accused Advanced Antenna Mobile Devices, such as smartphones and tablets (including but not limited to Galaxy S20-S25 model, the Galaxy Z Flip 3-6 model, the Galaxy Fold 3-6 model, and the Galaxy Note 20 model smartphones), are wireless devices at least because they are 5G compatible. The Accused Advanced Antenna Mobile Devices are configured to avoid radiation of a user or structure (e.g., an "obstacle") as described below.
[1A] one or more detectors selected from the group consisting of one or more cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, for detecting an orientation of said wireless device relative to either or both said user and said structure;	The Accused Advanced Antenna Mobile Devices include, among other things, proximity sensors for sensing proximity of an obstacle, such as a user body part, to the wireless device, and also for detecting an orientation of the wireless device. The sensor(s) used to detect the orientation of the device, such as proximity to an obstruction, include, but are not limited to, (i) a range finder embodied, in whole or in part, by the modem and RF front-end system of the Accused Advanced Antenna Mobile Devices, including the phased array module and associated transceiver, (ii) one or more capacitive sensors, (iii) one or more light detectors, and/or (iv) one or more gyroscopes. For example, the Accused Advanced Antenna Mobile Devices include infrared sources and detectors. Infrared is a form of light energy, so the Accused Advanced Antenna Mobile Devices include at least light detectors, whose output is used for computationally determining an orientation of the obstacle relative to the wireless device. See www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone. **How does the proximity sensor work?** A proximity sensor consists of a light-emitting and light-receiving component. Infrared rays from the light-emitting component analyze the light reflected from physical objects and measure the distance between the object and the device. The proximity sensor is installed under the display, on all the latest Galaxy smartphones and is now capable of detecting the angle of the device. Make a call and bring the phone close to your ear. The screen will turn off as you move the phone away, and the screen will wake up. The Accused Advanced Antenna Mobile Devices also include one or more gyroscopes that enable them to perform orientation detection. For example, the "Samsung Galaxy S21 Ultra

[1] Upon information and belief, all Accused Advanced Antenna Mobile Devices function in a substantially similar manner for the relevant accused functionality.

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	Teardown" and "Samsung Galaxy S22 Chip ID" articles describe ASICs used in the Samsung Galaxy S21 Ultra and S22 Ultra, including the STMicroelectronics LSM6DSO. The STMicroelectronics LSM6DSO is 3-axis accelerometer/gyroscope combination chip. *See* https://www.ifixit.com/Guide/Samsung+Galaxy+S22+Chip+ID/148072; https://www.ifixit.com/Teardown/Samsung+Galaxy+S21+Ultra+Teardown/141188. The Accused Advanced Antenna Mobile Devices detect, using the proximity sensors, an orientation of the wireless device relative to, for example, body parts of the user. *See* www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone. For example, the Accused Advanced Antenna Mobile Devices include accelerometers, capacitive sensors, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can detect the presence of the user. The Accused Advanced Antenna Mobile Devices use one or more of these sensors to detect the location that the user of the Accused Advanced Antenna Mobile Devices is gripping the device. The sensors are located near antenna patch of the antenna arrays so that the corresponding antenna patch can be deactivated to avoid the user. In another example, the Operational Description describes a grip sensor configuration that determines the presence and location of the user with a smart capacitive sensor. **1.11 Grip Sensor : SX9380** **1.11.1 General Description** The SX9380 is a smart capacitive sensor for SAR (Specific Absorption Rate). The resulting detection is used in portable electronic devices to reduce and control radio-frequency (RF) emission power in the presence of a human body, enabling significant performance advantages for manufacturers of electronic devices with electro-magnetic radiation sources to meet stringent emission regulations' criteria and Specific Absorption Rate (SAR) standards. *See* fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf ("Operational Description").

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<table>
<tr><td></td><td></td></tr>
<tr><td>[1B] one or more processors for determining, based on information provided by said one or more detectors, zones or spans of directions in the three dimensional space corresponding with one or more directions of said user or structure relative to said at least one steerable antenna;</td><td>The Accused Advanced Antenna Mobile Devices comprise one or more processors communicatively coupled to said one or more sensors, configured to determine zones or spans of directions in the three-dimensional space corresponding with one or more directions of either or both said user and said structure relative to said at least one steerable antenna.

For example, the table below shows certain Accused Advanced Antenna Mobile Devices comprising a variation of the Qualcomm Snapdragon processors. The Snapdragon processors are coupled to a plurality of sensors including an accelerometer, gyroscope, proximity sensor, infrared light sensor, and ambient light sensor to determine a location corresponding to a user or object.

<table>
<tr><td>S20</td><td>S21</td><td>S22</td><td>S23</td><td>S24</td><td>S25</td></tr>
<tr><td>Snapdragon 865</td><td>Snapdragon 888</td><td>Snapdragon 8 Gen 1</td><td>Snapdragon 8 Gen 2</td><td>Snapdragon 8 Gen 3</td><td>Snapdragon 8 Elite</td></tr>
</table>

See https://www.phonearena.com/phones/Samsung-Galaxy-S20_id11266

https://www.phonearena.com/phones/Samsung-Galaxy-S21_id11508

https://www.phonearena.com/phones/Samsung-Galaxy-S22_id11763

https://www.phonearena.com/phones/Samsung-Galaxy-S23_id11999

https://www.phonearena.com/phones/Samsung-Galaxy-S24_id12113

https://www.phonearena.com/phones/Samsung-Galaxy-S25_id12340

An Operation Description document, for an Accused Advanced Antenna Mobile Device, describes that the Accused Advanced Antenna Mobile Device includes one or more processors (see fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf (“Operational Description”) at sheet 13):</td></tr>
</table>

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	2.1 AP/CP : S5E8825 (EXYNOS1280) **1) Description** S5E8825 is a System-on-Chip (SoC), which is based on a 64-bit RISC processor. It also contains a 5G communication processor (modem), which is compliant with 5G NR features and all legacy features. S5E8825 targets high-end smart phones and tablet products. S5E8825 is based on the 5 nm low-power process and it provides the following features: ☐ Octa-core CPU (Dual-core ARM Cortex-A78 (Big CPU), and Hexa-cores ARM Cortex-A55 (Little CPU) ☐ 17.1 GB/s of LPDDR4 bandwidth ☐ WQHD embedded display ☐ 4K 30-frame video decoding (H.264/HEVC) and FHD 30-frame video decoding/encoding hardware (MPEG4/H.263/VP8) ☐ 3D graphics H/W ☐ Image Signal Processor (ISP) ☐ Neural Processing Unit (NPU) ☐ ABOX (Audio Sub-System) ☐ High-speed interfaces, such as UFS 2.2 and USB 2.0 DRD ☐ Embedded communication processor (5G NR FR1 FR2, 4G LTE, 3G FDD/TDD, 2G GSM/CDMA) ☐ GNSS and WiFi/BT ☐ Context HUB (CHUB) The one or more processors are for determining, based on information provided by said one or more detectors, zones or spans of directions in the three dimensional space corresponding with one or more directions of said user or structure relative to said at least one steerable antenna. The wireless device comprises one or more steerable antennas as describe in element [1C].
[1C] one or more steerable antennas which operate on one or multiple bands and radiates or receives at one or more	The Accused Advanced Antenna Mobile Devices comprise at least one steerable antenna that includes an antenna array which consists of multiple individual antenna elements arranged in a specific geometric pattern. Each antenna element radiates a signal, and the combination of these signals forms the overall radiation pattern of the array. Beamsteering is achieved by controlling the phase of the signals fed to each individual antenna element in the array.

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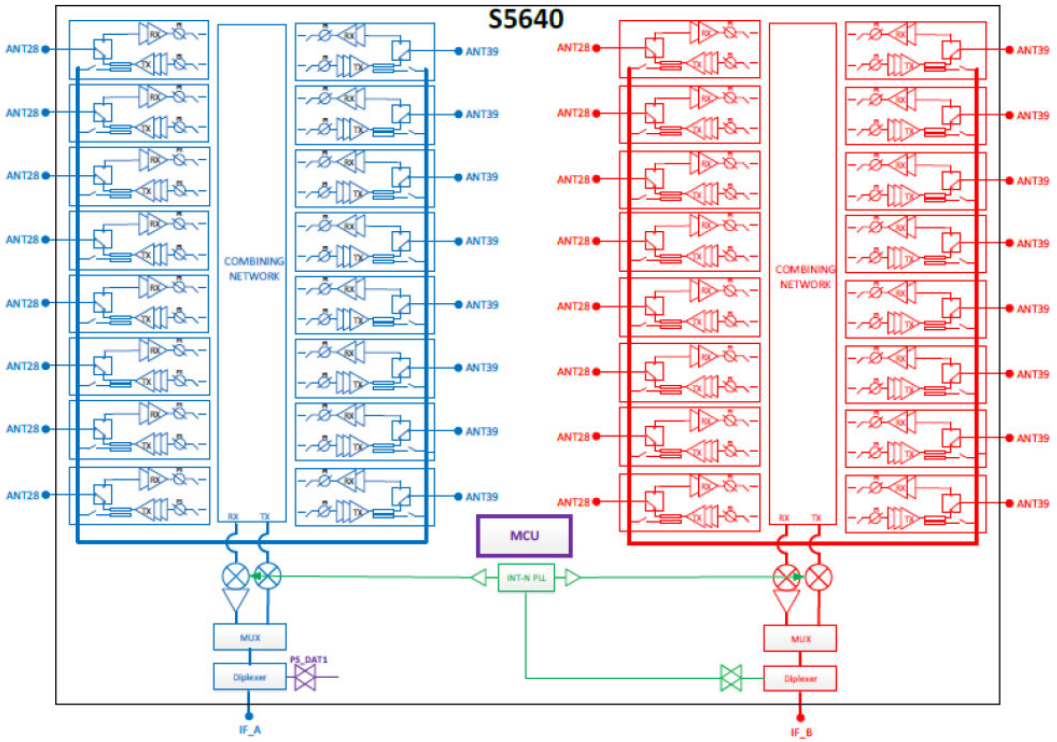
frequencies in the range of 10 GHz to 500 GHz,	The steerable antenna operates at one or more bands, and radiates or receives at frequencies in the range of 10 GHz to 500 GHz. The steerable antenna arrays in the Accused Advanced Antenna Mobile Devices are for 5G bands operating above 10 GHz and less than 500 GHz. For example, an Operational Description document for an Accused Advanced Antenna Mobile Device (e.g., SM-A536V model) describes the device as including a "mmW Antenna Module," which includes "two separate phased array chips (S5640)." Each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band.  *See* fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf ("Operational Description").

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	The Operational Description further describes that the Accused Advanced Antenna Mobile Device implements beamforming for 5G band n261, which has a frequency of 27.5 - 28.35 GHz, which is in the range of 10 GHz to 500 GHz.
[1D] wherein one or more beams of said one or more steerable antennas is adjustable to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions in the three dimensional space as determined by said one or more computational devices, wherein said one or more steerable antennas are configured to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions; and	The one or more steerable antennas in the Accused Advanced Antenna Mobile Devices is adjustable to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions in the three-dimensional space as determined by said one or more computational devices, wherein said one or more steerable antennas are configured to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions. For example, the Accused Advanced Antenna Mobile Devices determines an area or location associated with an obstruction and deactivates a corresponding antenna in the antenna array. In another example, the Accused Advanced Antenna Mobile Devices can determine transmission areas associated with beams that are associated with high and low signal attenuation. The Qualcomm article "5G Modems, RF and Antennas — Getting mmWave Data into the Device describes the QTM525 mmWave antenna module, included in certain Accused Advanced Antenna Mobile Devices, that allows "[t]he device and the network exchange information constantly, directing beams in a way they can best reach each other." *See* www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device

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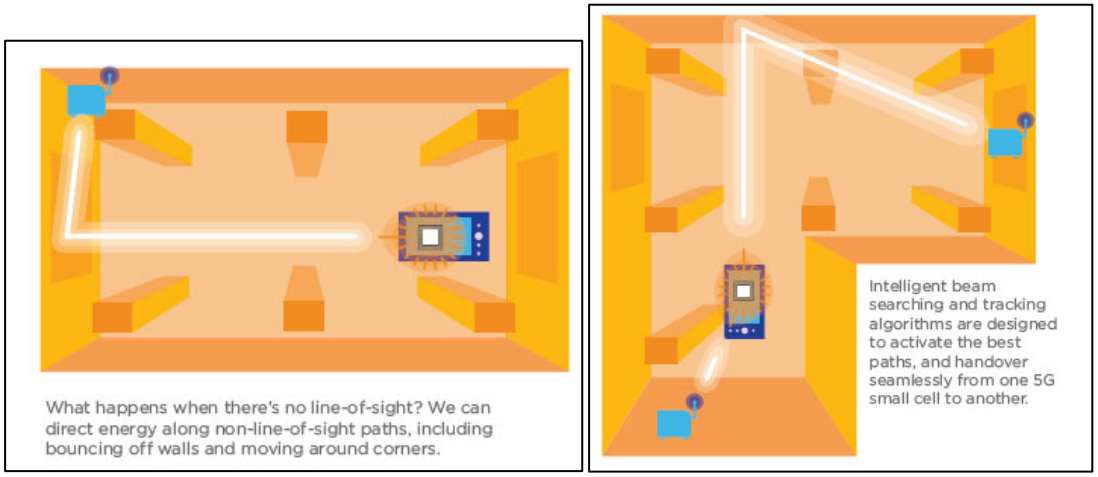
	The images below, from the Qualcomm document, shows that the Snapdragon X50 5G modem can perform beamsteering to avoid obstructions when direct line of sight transmission paths are not available.  See https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/x50info11.pdf In another example, the Operational Description describes that the Accused Advanced Antenna Mobile Device implements beamforming for 5G band n261.

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<table>
<tr>
<td></td>
<td>
<h2>Beamforming – n261</h2>
The mmWave operations in this device use beam-forming. The below beams are used in this device (no other beams or combinations of beams are supported.)
<table>
<tr><th></th><th>Patch/Dipole</th><th>SISO/MIMO & Polarization</th><th colspan="2">Beam ID</th></tr>
<tr><td rowspan="20">ANT L</td><td rowspan="20">Patch</td><td rowspan="7">Single beam / V-pole</td><td>0</td><td></td></tr>
<tr><td>1</td><td></td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td></td></tr>
<tr><td>6</td><td></td></tr>
<tr><td rowspan="6">Single beam / H-pole</td><td></td><td>7</td></tr>
<tr><td></td><td>8</td></tr>
<tr><td></td><td>9</td></tr>
<tr><td></td><td>10</td></tr>
<tr><td></td><td>11</td></tr>
<tr><td></td><td>12</td></tr>
<tr><td rowspan="7">Paired beam / MIMO</td><td></td><td>13</td></tr>
<tr><td>0</td><td>7</td></tr>
<tr><td>1</td><td>8</td></tr>
<tr><td>2</td><td>9</td></tr>
<tr><td>3</td><td>10</td></tr>
<tr><td>4</td><td>11</td></tr>
<tr><td>5</td><td>12</td></tr>
<tr><td>6</td><td>13</td></tr>
</table>
See fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf
</td>
</tr>
<tr>
<td>[1E] a controller for adjusting the radiation pattern of the one or more steerable antennas to accentuate one or more of said particular directions while</td>
<td>The Accused Advanced Antenna Mobile Devices comprise a controller for adjusting the radiation pattern of the one or more steerable antennas to accentuate one or more of said particular directions while attenuating the radiation pattern for said zones or spans of directions in the three dimensional space.</td>
</tr>
</table>

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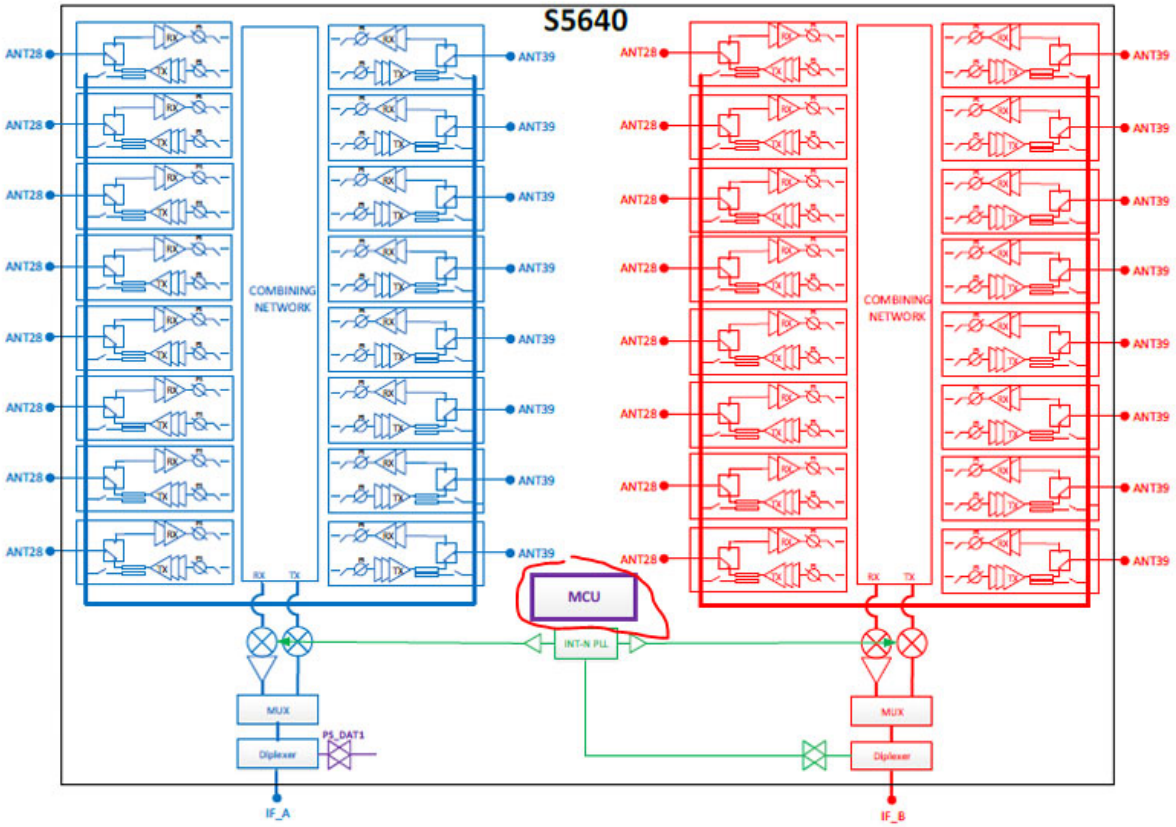
attenuating the radiation pattern for said zones or spans of directions in the three dimensional space.	For Example, the steerable antenna of an Accused Advanced Antenna Mobile Device is controlled by a microcontroller unit ("MCU"), as shown in the Operational Description, and controlling the radiation pattern from the steerable antenna accentuates particular directions while attenuating other directions, e.g., the ones for the obstacles.  A teardown of a Galaxy S20 Ultra describes that this Accused mmWave Product includes "two Qualcomm RF ICs … w/multilayer package substrate antenna array …" *See* electronics360.globalspec.com/article/15093/teardown-samsung-galaxy-s20-ultra-5g

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	The "Criticality of 5G Modem to RF Integration; A look inside Samsung Galaxy S20 Ultra" article (https://omdia.tech.informa.com/om006104/criticality-of-5g-modem-to-rf-integration-a-look-inside-samsung-galaxy-s20-ultra) describes a teardown of the S20 Ultra, including that the Qualcomm RF ICs in the Galaxy S20 Ultra are QTM525 mmWave Antenna modules. The Qualcomm article "5G Modems, RF and Antennas — Getting mmWave Data into the Device describes the QTM525 mmWave antenna module as including an "array of tiny mmWave antenna elements …." *See* www.qualcomm.com/developer/blog/2019/11/5g-modems-rf-and-antennas-getting-mmwave-data-device The Qualcomm article further describes the QTM525 mmWave antenna module, in communication with the 5G modems (e.g., Snapdragon X50, X55, X60), as capable of beamforming and beam tracking to avoid obstructions. mmWave technology works well in cities, where you can locate a small cell on top of a building and serve an entire block. In a dense, urban environment, the buildings would normally be an obstruction. But beamforming and beam tracking take advantage of them as an endless series of surfaces off of which the mmWaves can bounce. On the device, multiple mmWave antenna modules like the QTM052 and QTM525 are located in different places, as shown in the image below. The baseband modem switches among the antenna modules, depending on the source of the strongest signal. All of that takes place in real time in fractions of a millisecond. See *Id.*

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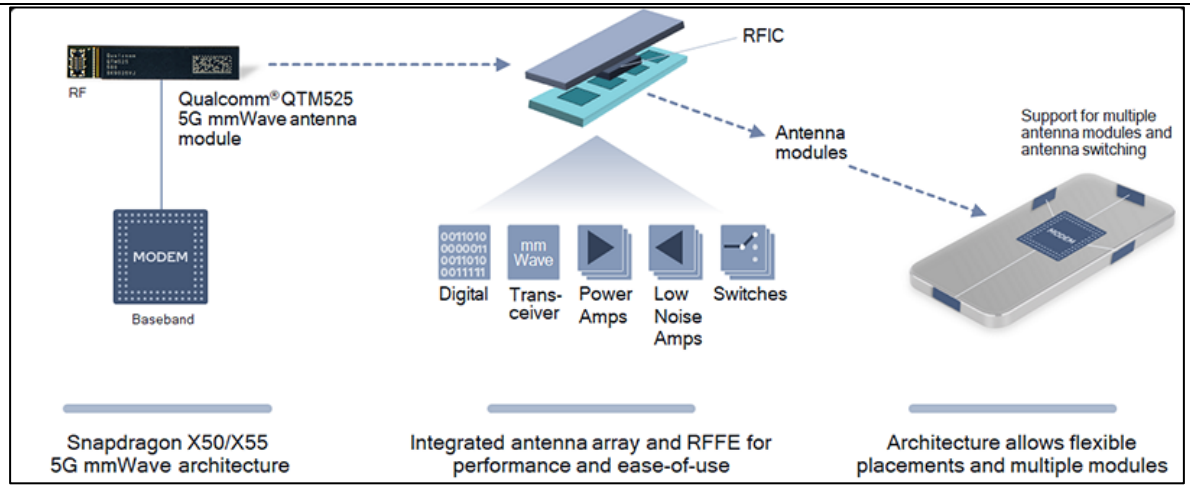

See *Id.*

Claim 3	Accused Advanced Antenna Mobile Devices
[3] The wireless device of claim 1 further comprising a tuner for tuning said at least one steerable antenna with one or more active elements which are selected or interconnected using electronic control.	The steerable is tuned by a tuner to operate at a selected frequency band. This is explained, for example, in "Criticality of 5G Modem to RF Integration; A look inside Samsung Galaxy S20 Ultra," April 2020 (omdia.tech.informa.com/om006104/criticality-of-5g-modem-to-rf-integration-a-look-inside-samsung-galaxy-s20-ultra, hereinafter "Omdia"), which explains that with all of the higher 5G frequencies, the solution is "antenna tuners." With all these different higher 5G frequencies requiring 4x4 MIMO, antenna design becomes much more daunting in modern 5G devices. A typical LTE device may have upwards of 6 cellular antennas. Some high-end devices exhibit more due to the higher number of frequencies supported. However, the volume inside a device like the smartphone is still finite and designers can only fit in so many physically tuned antennas. The solution for that are antenna tuners. Antenna tuners are vital to 5G as higher frequencies and 4x4 MIMO requirements drive up need for more antennas. In the case of the Galaxy S20 Ultra design, Samsung is using up to five Qualcomm antenna tuners in the design.

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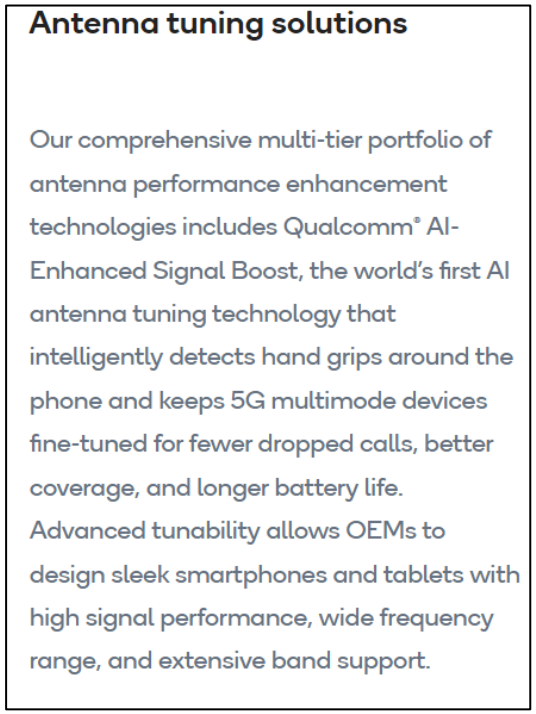
	The Qualcomm Snapdragon (SN) modems, which are in at least some of the Accused Advanced Antenna Mobile Devices, include "antenna modules" with "adaptive antenna tuning." *See* https://www.qualcomm.com/products/technology/modems/rf.  *See also* Snapdragon X55 and 5G RF datasheet. device.report/m/1cde5ac9c829a48d5afe8d9aadb0d0c993271ff7e3247850068f17979106bfad

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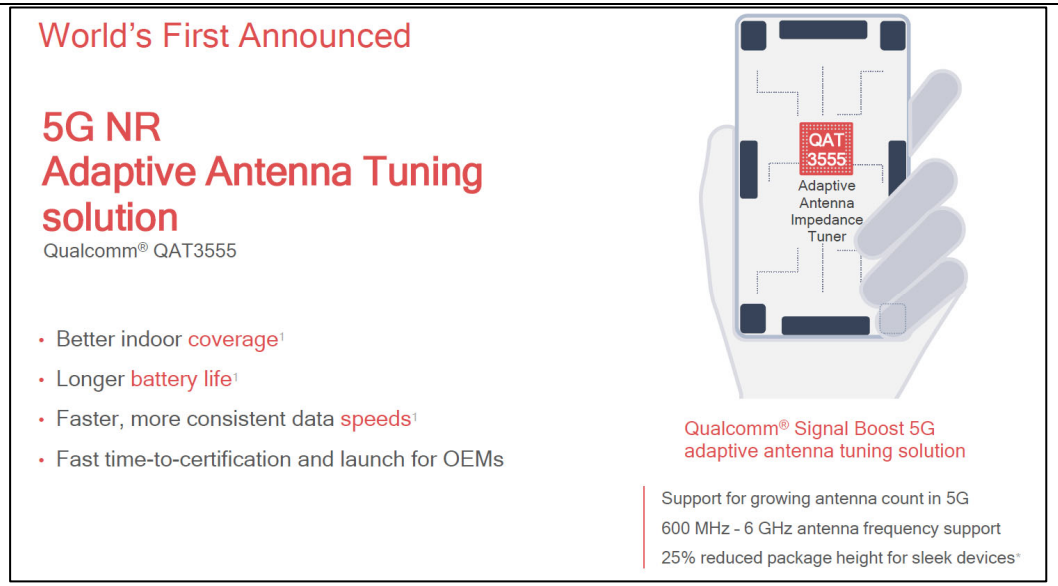

See www.slideshare.net/slideshow/

powerpointpresentationmaking5gnrarealityfebruary2020webpdf/252983614

See also "Qualcomm Announces Second Generation 5G RF Front-End Solutions for Sleeker, More Efficient 5G Multimode Mobile Devices," Feb. 2019 (www.qualcomm.com/news/releases/2019/02/qualcomm-announces-second-generation-5g-rf-front-end-solutions-sleeker-more), which describes that its Snapdragon 5G modems include an "adaptive antenna tuner" for "extending adaptive tuning technology to 5G bands up to 6 GHz …"

> To help OEMs address the growing number of antennas and frequency range support required in mobile devices, Qualcomm Technologies has also introduced the QAT3555 Signal Boost adaptive antenna tuner, extending adaptive antenna tuning technology to 5G bands up to 6 GHz, while featuring a 25% reduced package height, and lower loss compared to the previous generation.

A Qorvo White Paper, "Aperture Tuning: An Essential Technology in 5G Smartphones" (www.qorvo.com/resources/d/qorvo-antenna-tuning-essential-technology-5g-smartphones-

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	white-paper) explains that to accommodate the multiple antennas needed for 5G, but in small phone form factor, "[a]perture tuning compensates for this problem by allowing antennas to be tuned to operate efficiently on multiple bands …" and that "[a]perture tuning also lets antennas communicate on multiple bands simultaneously to support" carrier aggregation. Antenna aperture tuning is essential to enable smartphones to operate efficiently over the ever-increasing range of RF frequency bands and support the transition to 5G. Smartphones need more antennas to support growing RF requirements such as new 5G bands, MIMO, and carrier aggregation (CA), but there is less space for these antennas due to changes in smartphone industrial design. As a result, antennas are becoming smaller, potentially reducing antenna efficiency and bandwidth. Aperture tuning compensates for this problem by allowing antennas to be tuned to operate efficiently on multiple bands and increasing Tx and Rx performance by 3 dB or more. Aperture tuning is implemented with switches combined with other tuning components; switches with low RON and low COFF are critical to maximize efficiency. Aperture tuning also lets antennas communicate on multiple bands simultaneously to support CA. Implementing aperture tuning requires in-depth knowledge of how to apply the technology for each application. This paper explains that aperture tuning utilizes a switch along with a capacitor and/or inductor as tuning components. This is an example of "active" tuning. (i.e., part (a) of this claim element). Samsung uses Qorvo's RF solutions for its Galaxy platform. *See* www.qorvo.com/newsroom/news/2021/qorvo-recognized-by-samsung-for-best-quality-in-mobile; www.techinsights.com/blog/deep-dive-teardown-samsung-galaxy-s24-sm-s921bds-smartphone. Below is an image from teardown of a Galaxy S20 Ultra showing 4 antenna tuners. *See* Omdia.

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	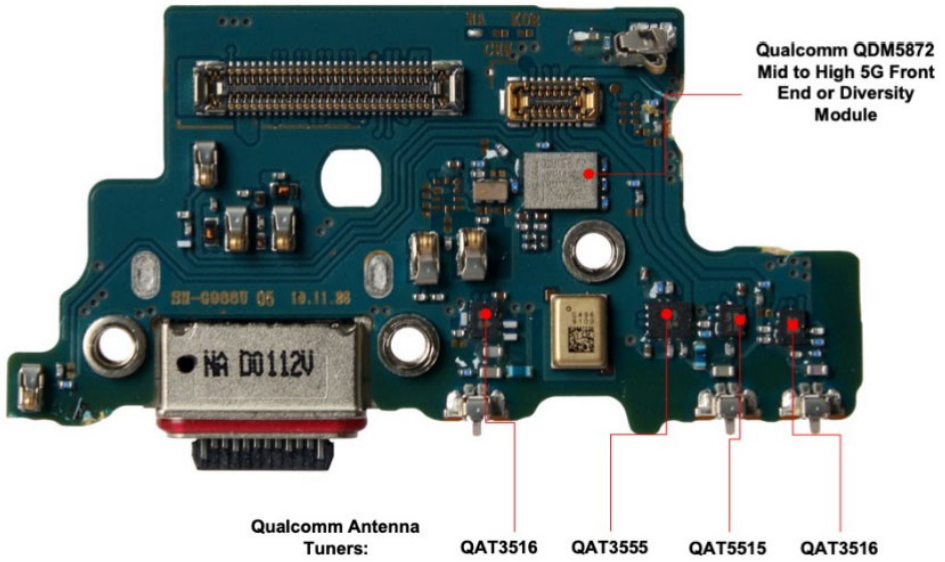
Claim 6	**Accused Advanced Antenna Mobile Devices**
[6] The wireless device of claim 1, wherein said at least one steerable antenna comprises a plurality of steerable antennas.	The Accused Advanced Antenna Mobile Devices comprise at least one steerable antenna that further comprises a plurality of steerable antennas. According to the Operational Description, the Accused mmWave Product includes a "mmW Antenna Module," which includes "two separate phased array chips (S5640)." Each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band.

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	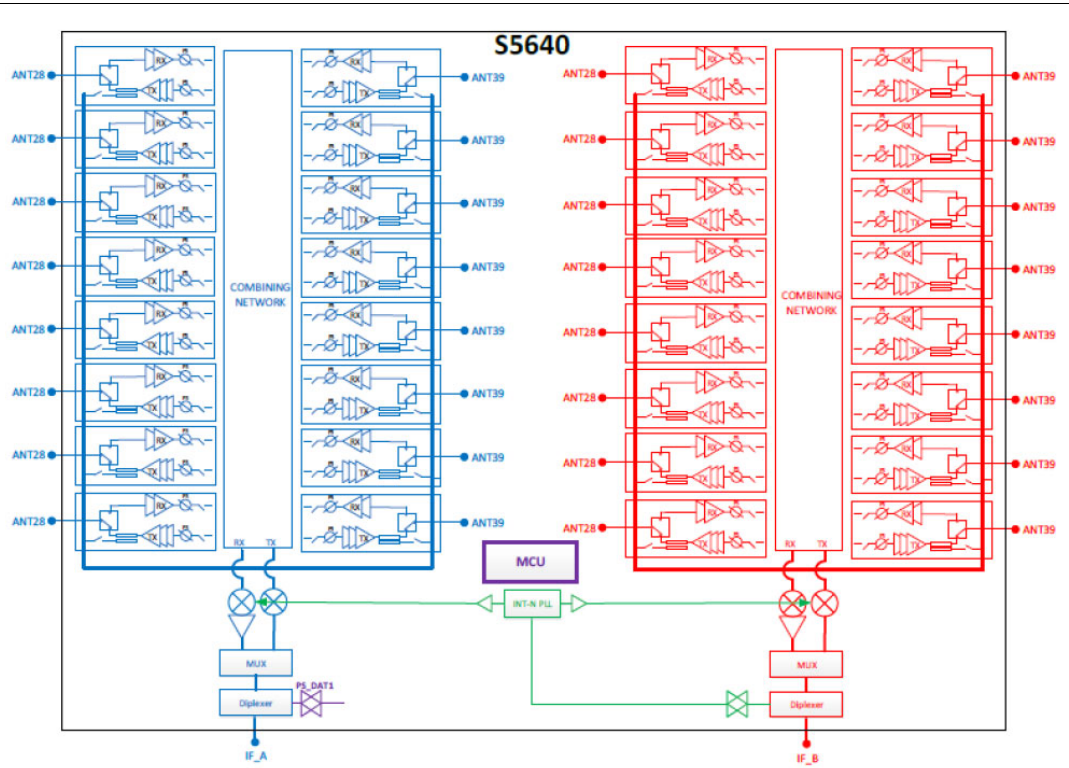 See fccid.io/A3LSMA536V/Operational-Description/A3LSMA536V-Operational-Description-Main-Part-R4-5651659.pdf
Claim 7	**Accused Advanced Antenna Mobile Devices**
[7PRE] A method for avoiding or reducing radiation of a user or structure by a wireless device having at least one [*steerable*] antenna, comprising:	The Accused Advanced Antenna Mobile Devices are wireless devices at least because they are 5G cellular compatible. The Accused Advanced Antenna Mobile Devices are configured for performing a method for avoiding or reducing radiation of a user or structure (e.g., an "obstacle") as described herein. The Accused Advanced Antenna Mobile Devices comprise at least one steerable antenna as described in connection with claim element [1C] above. *See* claim element [1PRE] above.

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[7A] sensing with one or more sensors selected from the group consisting of cameras, microphones, audio sensors, ultrasound sensors or transducers, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	*See* claim element [1A] above.
[7B] receiving signals from said one or more sensors pertaining to said orientation in the three dimensional space;	The Accused Advanced Antenna Mobile Devices comprise a plurality of sensor including an accelerometers, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can communicate with the processor to determine the relative orientation of the device and three-dimensional spaces. *See* claim element [1B] above.
[7C] using said signals, computing zones or spans of directions corresponding with one or more directions of said user or structure relative to said at least one steerable antenna in the three dimensional space; and	

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[7D] adjusting one or more beams of said at least one steerable antenna to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions,	The one or more steerable antennas in the Accused Advanced Antenna Mobile Devices is adjustable to accentuate its radiation pattern in one or more directions which are not in said zones or spans of directions in the three-dimensional space as determined by said one or more computational devices. The Operational Description describes that the Accused mmWave Product implements beamforming for 5G band n261. Beamforming – n261 The mmWave operations in this device use beam-forming. The below beams are used in this device (no other beams or combinations of beams are supported.)

	Patch/Dipole	SISO/MIMO & Polarization	Beam ID	
ANT L	Patch	Single beam / V-pole	0	
			1	
			2	
			3	
			4	
			5	
			6	
		Single beam / H-pole		7
				8
				9
				10
				11
				12
				13
		Paired beam / MIMO	0	7
			1	8
			2	9
			3	10
			4	11
			5	12
			6	13

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	See claim element [1D] above.
[7E] wherein said at least one steerable antenna radiates or receives said one or more beams based on signals from said one or more processors determined on execution of said executable instructions,	The at least one steerable antenna radiates or receives said one or more beams based on signals from said one or more processors determined on execution of said executable instructions. The Operational Description explains how the steerable antenna is controlled, including by a modem chip. See Operational Description at § 1.9.2.

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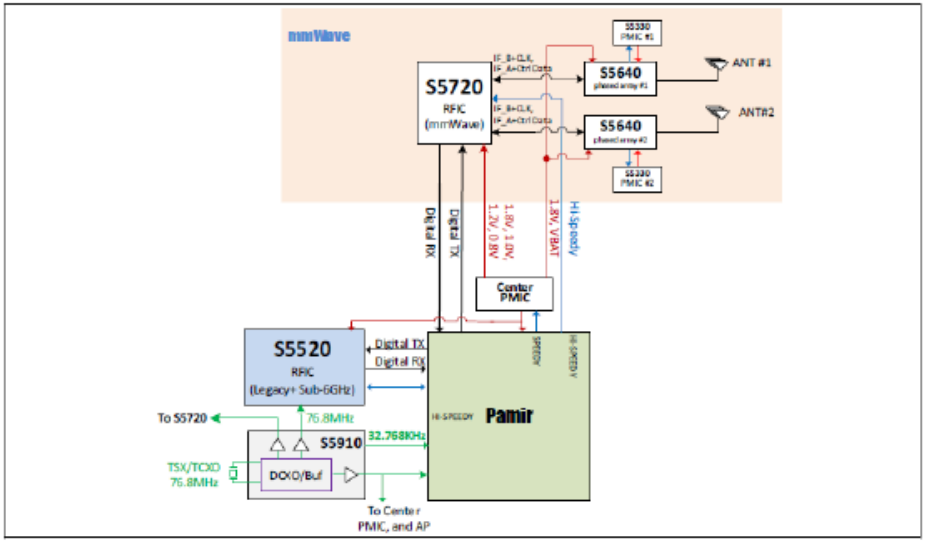
Figure 1-1 shows one 5G NR solution for cellular handsets. It consists of one S5720, one modem chip (Pamir) and two separate phased array chips (S5640). The modem uses digital interface for communication to S5720 (both receive and transmit). Inside the S5720 in the transmitter mode, these signals are filtered and up-converted to an intermediate frequency (IF) and sent via the four IF ports to the two phased array chips. These IF ports also allow control data and clock, and 560MHz reference clock to be sent from S5720 to the phased array chips. Note that the S5720-to-S5640 IF interconnection loss at the clock frequency must not exceed 1dB, so that the clock input power at the S5640 clock input is at least -8 dBm. S5720 can connect to two phased array chips but only one phase array can work in the transmitter mode, and two can be operating concurrently in the receiver mode. Note that S5640 supports two types of control interface: PSpeedy and HSpeedy. The configuration shows the use of PSpeedy, where both clock and data are multiplexed along with the IF signals.



See claim element [1D] above.

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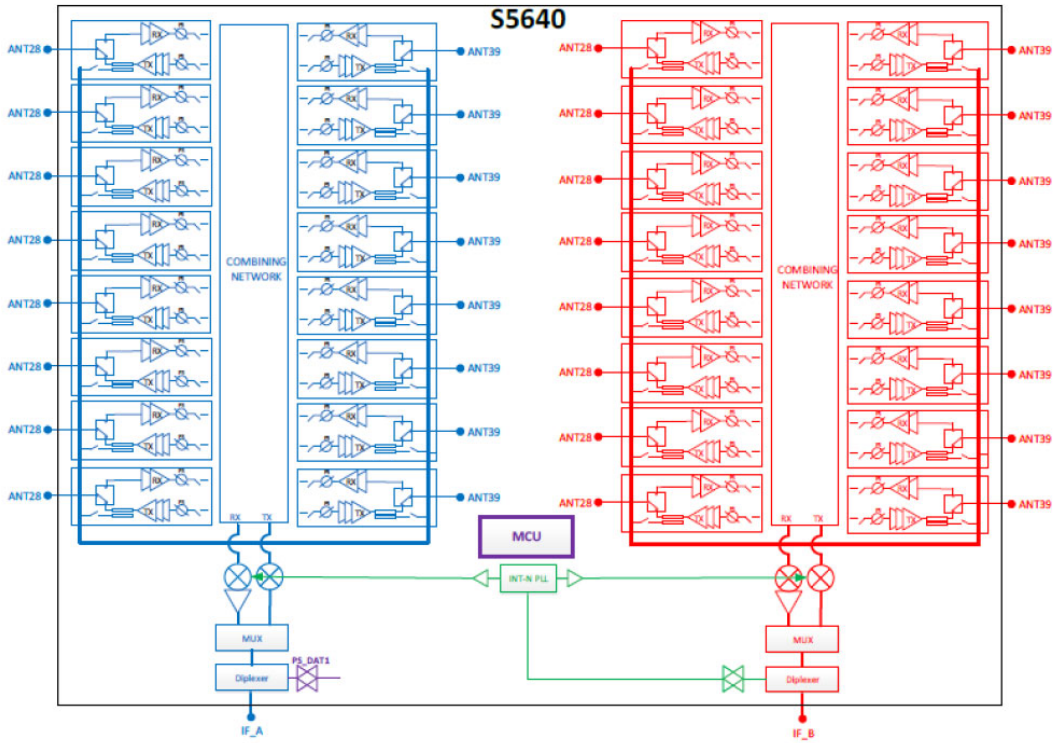
[7F] wherein said at least one steerable antenna operates on one or multiple bands, and	The steerable antenna arrays in the Accused Advanced Antenna Mobile Devices are for 5G bands operating above 10 GHz and less than 500 GHz. According to the Operational Description, each phase array chip includes 20 antenna ports: 10 for 28 GHz band and 10 for 39 GHZ band.  *See* fcc.report/FCC-ID/A3LSMA536V/5651659.pdf ("Operational Description"). See claim elements [1B] - [1D] above.
[7G] wherein said at least one steerable antenna radiates or receives at one or more	The Accused Advanced Antenna Mobile Devices comprise at least one steerable antenna that operates at one or more bands, and radiates or receives at frequencies in the range of 10 GHz to

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frequencies in the range of 10 GHz to 500 GHz.	500 GHz. The steerable antenna arrays in the Accused Advanced Antenna Mobile Devices are for 5G bands operating above 10 GHz and less than 500 GHz. The Operational Description describes that the Accused mmWave Product implements beamforming for 5G band n261, which has a frequency of 27.5 - 28.35 GHz, which is in the range of 10 GHz to 500 GHz. See claim elements [1C] above.
Claim 9	**Accused Advanced Antenna Mobile Devices**
[9] The method of claim 7 further comprising tuning said at least one steerable antenna with one or more active elements which are selected or interconnected using electronic control.	See Claim [3] above.
Claim 10	**Accused Advanced Antenna Mobile Devices**
[10] The method of claim 7 wherein said at least one steerable antenna is configured for transmitting, receiving, or transmitting and receiving simultaneously in a plurality of different bands.	The antennas and 5G modems used by a plurality of transmitters, receivers or transceivers in the Accused Advanced Antenna Mobile Devices are configure for simultaneous reception and transmission in different frequency bands. For example, the Accused Advanced Antenna Mobile Devices comprise Qualcomm Snapdragon 5G solutions include transceivers. See https://www.qualcomm.com/developer/blog/2021/05/riding-wave-5g-millimeter-time ("Our first 5G product, the Snapdragon® X50 5G Modem-RF System introduced in 2016, is backed by the Qualcomm® QTM052 mmWave antenna module. The system also combines 5G transceivers, power management, and RF front-end components, including power amplification and a phased-antenna array to focus mmWave signals for beamforming.") The 5G modem supports active tuning with the antenna to permit the reception and transmission of wireless communication on two different bands simultaneously. See www.qorvo.com/design-hub/blog/4-things-to-know-about-antenna-tuning-in-4g-5g-smartphones

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	CA combines two or more LTE carriers, often in different frequency bands, to deliver increased bandwidth and higher data rates. Due to the limited total number of antennas in handsets, this often means that a single antenna must communicate on two bands simultaneously. See also www.qorvo.com/resources/d/qorvo-antenna-tuning-essential-technology-5g-smartphones-white-paper, which explains that to accommodate the multiple antennas needed for 5G, but in a small phone form factor, "[a]perture tuning compensates for this problem by allowing antennas to be tuned to operate efficiently on multiple bands …" and that "[a]perture tuning also lets antennas communicate on multiple bands simultaneously to support" carrier aggregation.
Claim 12	**Accused Advanced Antenna Mobile Devices**
[12PRE] A method for avoiding radiation of a user or structure by a wireless device with a steerable antenna system, comprising:	See claim element [7PRE] above.
[12A] detecting in a three dimensional space with one or more sensors selected from the group consisting of one or more cameras, microphones, audio sensors or transducers, ultrasound sensors, range finders, capacitive sensors, gyroscopes, light detectors, or motion detectors used for computational determination of spatial orientation in three dimensional space, an orientation of said wireless device relative to either or both said user and said structure;	The Accused Advanced Antenna Mobile Devices include, among other things, proximity sensors for sensing proximity of an obstacle, such as a user body part, to the wireless device, and also for detecting an orientation of the wireless device. For example, the Accused Advanced Antenna Mobile Devices include infrared sources and detectors. Infrared is a form of light energy, so the Accused Advanced Antenna Mobile Devices include at least light detectors for sensing an orientation of the obstacle relative to the wireless device. See www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone. **How does the proximity sensor work?** A proximity sensor consists of a light-emitting and light-receiving component. Infrared rays from the light-emitting component analyze the light reflected from physical objects and measure the distance between the object and the device. The proximity sensor is installed under the display, on all the latest Galaxy smartphones and is now capable of detecting the angle of the device. Make a call and bring the phone close to your ear. The screen will turn off as you move the phone away, and the screen will wake up. The Accused mmWave Product detect, using the proximity sensors, an orientation of the wireless device relative to, for example, body parts of the user. *See*

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	www.samsung.com/ph/support/mobile-devices/what-is-this-proximity-sensor-on-your-samsung-smartphone.
[12B] computing, with a computation module communicatively coupled to said one or more sensors, zones or spans of directions in the three dimensional space;	The Accused Advanced Antenna Mobile Devices comprise a plurality of sensor including an accelerometers, gyroscopes, and proximity sensors in the form of ambient light sensors and/or infrared light sensor that can communicate with the processor to determine the relative orientation of the device and three-dimensional spaces. A processor of the wireless device that communicates with the steerable antenna is an example of the "computation module." The Accused Advanced Antenna Mobile Devices comprise processors for communicating with the steerable antenna. See claim element [1B] above.
[12C] adjusting at least one steerable antenna that operates on one or multiple bands, which radiates or receives at one or more frequencies in the range of 10 GHz to 500 GHz, and that is communicatively coupled to said computation module, so that the at least one steerable antenna radiates or receives one or more beams in one or more directions while attenuating its radiation pattern in said zones or spans of directions in the three dimensional space,	See claim elements [7D] - [7G] above.
[12D] wherein said zones or spans of directions correspond with one or more directions or locations of	See claim element [1B] above.

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said user or structure relative to said at least one steerable antenna in the three dimensional space,	
[12E] wherein said at least one steerable antenna is adjusted in the adjusting step to steer or direct its radiation pattern in particular directions while attenuating the radiation pattern in other directions in the three dimensional space.	See claim elements [1C] – [1E] above.
Claim 14	**Accused Advanced Antenna Mobile Devices**
[14] The method of claim 12 further comprising tuning said at least one steerable antenna with one or more active elements which are selected or interconnected using electronic control.	See claim [3] above.
Claim 15	**Accused Advanced Antenna Mobile Devices**
[15] The method of claim 12 wherein said at least one steerable antenna is configured for transmitting, receiving, or transmitting and receiving simultaneously in a plurality of different bands.	See claim [10] above.